DOCUMENT RESUME

ED 216 899 SE 037 876

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TITLE College Student Attitude toward Computer-Managed Instruction in an Introductory Biology Course.
PUB DATE May 82
NOTE 74p.

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Attitude Change; *Attitude Measures; *Biology; *College Science; College Students; *Computer Managed Instruction; Higher Education; Science Education; Science Instruction; *Student Attitudes; Test Reliability
IDENTIFIERS *Science Education Research

ABSTRACT

The purpose of this study was to determine the attitudes of students toward a computer managed instruction (CMI) biology course module and to check the internal consistency of the item banks on the test instrument. CMI as used in this study refers to the use of a computer to assist the instructor with routine management tasks in teaching such as testing, guidance, record keeping, and providing feedback to students. Specific areas addressed included whether: (1) students' attitudes toward CMI improved as a result of the experience; (2) students felt positive or negative about specific affective and operational aspects of CMI; and (3) whether improvements should be made in the item bank. Attitude scales (included in appendices) were administered to participants (N=64) on a pretest/posttest basis. Findings indicate an overall positive attitude change. Use of computer terminals did not appear to make students feel that instructors lacked concern toward their learning progress. Students favored immediate diagnostic feedback and opportunity to take tests at their convenience, considering CMI to be both a testing and learning experience. Correlation coefficients on total test and subscale internal consistency are reported with suggestions for improving the instruments. (Author/JN)

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COLLEGE STUDENT ATTITUDE TOWARD COMPUTER-MANAGED INSTRUCTION IN AN INTRODUCTORY BIOLOGY COURSE

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CHAPTER I

INTRODUCTION

During the last seven years at South Dakota State University, the Biology Department has offered two courses using a computer-managed instruction (CMI) approach. The major reasons for employing computer-managed instruction was to relieve instructors of the tedious, managerial tasks associated with student testing and evaluation and allow them to devote more time to their primary role of teaching. The student was also expected to benefit from this strategy. By using a computer terminal for testing purposes, students were provided with immediate feedback on answers and guidance would be offered for areas of needed study.

An earlier study at South Dakota State University by Austreim (1975) attempted to determine the usefulness of a confidence testing scale employed in a Biology 151 CMI course. This study also focused on the Biology 151 CMI course, but was concerned with student attitude toward the CMI approach.

Statement of the Problem

The purpose of this research project was to attempt to determine the attitude of students toward a computer-

managed instruction portion of an introductory Biology 151 course. The author believed that attitudes toward CMI would be largely favorable. It was also believed that many elements, both positive and negative, contributed to the overall attitude of students toward CMI. As part of the research design, it was also necessary to measure the content validity and internal consistency of the items in the item bank.

Research Questions

1. Do students' attitudes toward components of computer-managed instruction improve from their pre-experience state to their post-experience state at South Dakota State University?

2. After participating in a computer-managed instruction module, how do students feel about affective and operational aspects of the educational strategy?

3. What improvements can be made in the item bank following content validity and internal consistency measures?

Importance of the Study

The important consideration of this study was to critically analyze the attitudinal responses of end users of the CMI system. By identifying problems associated with

this instructional strategy at South Dakota State University, future CMI course plans could anticipate these problems and correct them. When expansion of the data processing facilities at South Dakota State University becomes a reality, this study might also serve as an indicator of student feelings toward the CMI and facilitate a greater use of this method of management. Finally, content validity and internal consistency measures could serve as indicators for future item bank improvement processes.

Limitations of the Study

Many of the attitudes an individual might have toward a computer mediated program cannot be assessed in a pre-experience state. To attempt to ask or explain an attitude question that required a *priori* knowledge would influence subject responses and skew results. As a result of this fact, only ten attitude measures not requiring a *priori* knowledge of CMI systems were used in a pretest and posttest manner. The majority of attitude measures required a CMI experience on the part of the subject, and therefore, were administered solely in a posttest fashion.

The item bank internal consistency measures were taken from a single pretest administration. A posttest of the item bank was not attempted due to the excessive

length of the test and limited amount of laboratory time available during the later part of the semester. Of the 150 items pretested, only 148 were analyzed because of mechanical limitations imposed by the optical sheet scorer available at the University.

Characterization of Terms

The rapid growth of computer technology application in the field of education has been paralleled by a proliferation of accompanying technical terminology. For the convenience of the reader, the following terms are briefly defined.

Attitude. For the purpose of this study, attitude was the predisposition or tendency to react specifically to an object, situation, or value.

Computer-Assisted Instruction (CAI). For the purpose of this study, CAI meant teaching and learning with the direct aid of a computer. CAI was also referred to in the literature as both computer-based education (CBE) and computer-assisted learning (CAL).

Computer-Managed Instruction (CMI). For the purpose of this study, CMI referred to the use of a computer to assist an instructor with the routine management tasks in teaching such as testing, guidance, record keeping, and reporting. It was also referred to as computer-managed learning (CML) in the literature.

Internal consistency. For the purpose of this study, internal consistency was the quality in a test of having items which all measure the same thing on a specific objective or objectives and therefore are considered interrelated. Internal consistency is the most common form of reliability assessment used in the area of education.

Item bank. For the purpose of this study, an item bank was a collection of test questions gridded by objectives which were used by a computer program to automatically generate new tests over an entire series of objectives.

CHAPTER II

REVIEW OF THE LITERATURE

Development of Computer-Managed Instruction

The historical development of computer-managed instruction has been relatively short and diffuse. Cowen (1973) reported that computers were introduced onto university campuses in the early nineteen fifties and were used as computational devices in the scientific disciplines. He further stated that in the early sixties, a variety of advances in computer technology made possible the widespread use of computers for instruction. Cowen outlined four basic modes: (a) computer-assisted instruction, (b) computer-managed instruction, (c) computer-augmented learning, and (d) computer education.

In a performance study, Dunn (1971) listed three major individualized instruction projects using the computer to manage the instructional process. The three prototype programs were: (a) Project PLAN (Program for Learning in Accordance with Needs), (b) the IPI (Individually Prescribed Instruction), and (c) the Instruction Management System. These early systems shared several traits. Finch (1972) reported that these early systems read test responses by means of optical scan devices, processed input

in the batch mode, and results were generally available to students on a twenty-four hour turn-around basis.

Dunn succinctly outlined the CMI process as demonstrated by these three major systems:

> All of these systems specify units of instruction with stated objectives. Each student takes a pretest which is read by an optical scanner and scored by the computer. Based on the program logic, the student is then assigned to specific learning tasks. Either the computer makes this decision or the information is given to the teacher who makes the decision. The student's progress towards the objectives is assessed at various points within the unit; decisions are made to allow the student to continue or provide remedial exercises. When the student completes the assigned tasks, he takes a criterion-referenced posttest. This test is also scored by computer. If the student does not reach criterion, remedial procedures can be assigned. If criterion is achieved, the student can proceed to the next unit. (p. 12)

Parkus (1970) suggested that with further technical advances in hardware design, cathode ray tube (CRT) ter-

minals acted as the interface between students and computer on an online basis. Allen, Meleca, and Myers (1972) mentioned the usage of software packages such as IBM's Coursewriter and the availability of CRT terminals as a means for many institutions to readily move into the computerized instructional arena. Ohio State University, South Dakota State University, and Florida State University were just three of the many universities beginning to use computer-managed instruction as reported by both Allen (1972) and Lawler (1974). Online computer interactions offered the appealing element of immediate feedback to student response.

Student Attitude Toward Computer-Managed Instruction

There were many studies in the seventies that attempted to analyze the affective elements of computer-based instructional settings. Kulik, Kulik, and Cohen (1980) found that many of these studies failed to show statistically reliable differences favoring computer-managed instruction. Results more often than not contained merely qualitative reactions toward instructional methods.

The United States Armed Forces invested a large sum of capital in developing CMI and CAI programs for personnel training during the last two decades. Studies by Hansen (1975), Stern (1978), and Dobrovolny (1979) were

typical of military educational research in this area. These researchers tended to concentrate on factors of cost-effectiveness, training time reduction, and improved subject performance. Treatment of participant attitudes in the CMI setting tended to be cursory and sketchy.

Educational research at the university demonstrated more concern and emphasis on the affective domain of computer-managed instruction. Several of the earliest studies came from Florida State University. Kromhout, Edwards, and Schwarz (1969) used CMI in an undergraduate physics course, while Towle, Cohen, and Cohen (1973) worked with psychology classes. Both found significant improvements in student test performance. Their studies of student attitudes were simplistic. Though their results were positive, they were not statistically significant.

Hammer and Henderson (1972) conducted a study on what they termed Computer Generated, Repeatable Tests (CGRT), which was the equivalent to a CMI strategy. Their study demonstrated a keen understanding of the potential use for CMI in improving large enrollment classes. Hammer and Henderson felt that the testing methods usually associated with these types of classes were detrimental to the learning process. Objective tests used in these classes tended to be used solely as evaluative devices rather than learning devices. Feedback on traditional exams was ex-

tremely slow and promoted an inactivity-cramming approach to course study. The CGRT approach attempted to overcome these drawbacks by allowing repeatable mastery testing and flexible scheduling. Student attitudes were positive, though founded strictly on posttest percentages based on frequencies of responses. One interesting portion of the Hammer and Henderson study showed that students were concerned about item bank reliability. This concern was also shared by the researchers and was substantiated by relatively low levels of internal consistency. Geisinger (1976) in his research also displayed concern over the problems of item bank construction in a CMI course. Face validity and content validity approaches were taken in order to improve the quality of the test questions in Geisinger's project.

Hammer and Henderson also felt that students using CMI tended to view their instructor as a coach, rather than as an adversary. The two also found that student anxiety levels in regard to CMI testing were much lower than toward conventional testing. Other studies that examined the use of CMI and its effect upon student anxiety levels included O'Neil (1970), Dunn (1971), and O'Neil, Hedl, Richardson, and Judd (1976). Each of these studies demonstrated varying degrees of reductions in test-taking anxiety levels of students using the CMI strategy. These

researchers were basically studying a premise articulated by McCombs, Eschenbrenner, and O'Neil (1973) which stated that an effective instructional strategy should reduce anxiety levels and also lead to performance at a mastery level.

Other studies that specifically viewed student attitudes toward CMI were Cartwright and Derevensky (1975, 1976). These researchers studied the effects computer-managed testing (a form of CMI) had on students' later attitudes toward CAI. One of the points that was revealed in these studies was that students found the computer-assisted testing to be more of a learning experience than an evaluative experience.

Some of the most encouraging studies found included those conducted by Torop (1975), Roll and Pasen (1977), and Fisher, Williams, and Roth (1981). Torop's research indicated that students preferred their CMI classes significantly better than conventional course instruction and testing. He also found that the CMI approach resulted in better student attitude toward the discipline of chemistry which was being taught. Roll and Pasen performed a comparative study between a personalized system of instruction in a conventional instructional format and a module course in a CMI format. The CMI approach produced significantly better student performance. Students felt

that they learned concepts better by CMI and that they found the test-taking portion of CMI tended to be much more pleasant than traditional testing procedures. Fisher, Williams, and Roth also analyzed student attitudes toward a Computer-Assisted Self-Evaluation (CASE) system in a genetics course. The instructional strategy was equivalent to CMI. Their findings indicated that students liked the CASE system significantly better than the conventional course with a midterm. The CMI students felt that the course text contributed significantly to their learning whereas students in a traditional setting did not. Student motivation levels were also found to be higher among the CASE participants. In terms of performance, students using the CASE system were found to have significantly better performance records in the course and better long-term retention measured after a two year interval.

CHAPTER III

METHOD

Research Population

The computer-managed instruction study was conducted on all students enrolled in three Wednesday laboratory sections of the introductory biology course, Biology 151. The research was performed during the spring semester of 1981. Permission to undertake the study was obtained from the entire team of instructors involved in teaching the course. It was unanimously decided by the team that no voluntary assignment of students to the CMI experiment sections would be made. Students were not notified of their participation in the study until the first laboratory session was held. Non-voluntary assignment was used in an effort to prevent any selective biases from influencing the make-up of the research population. A total of seventy students participated in the online testing portion of the CMI study. Of the seventy students, sixty-four completed both the pretest and posttest portions of the study. The attrition of the six students was due to section changes and course drops after the CMI testing had begun. The research population was comprised of 28

females and 36 males, ranging in age from 18 to 23. Being a lower division course, the great majority of students were freshmen and sophomores.

Instrumentation

Pretest

A pretest attitude instrument composed of ten items (see Appendix A) was administered to subjects using IBM Form 1230 optical scoring sheets for answer recording. Students were required to supply their names and student identification numbers. The pretest was designed to elicit student attitudes toward the concept of using a computer terminal to take tests and guide them to areas of needed study.

Posttest, Items 1 through 30

The posttest attitude instrument concerning CMI (see Appendix B) was composed of the same ten items found on the pretest. Following these ten items, there were twenty additional attitude statements which attempted to measure students' feelings about their CMI experience. As in the pretest, answers were recorded on IBM Form 1230 optical scoring sheets. Again, students were required to supply names and student identification numbers on these sheets for the purpose of paired analysis.

Posttest, Items 31 through 40

The last ten items of the posttest (see Appendix B) attempted to ascertain students' attitude toward the computerized instructional facilities and operations at the South Dakota State University CAI Center. The Likert rating scale used on these items was different from that on items one through thirty (see Appendix B). These answers were also recorded on the same optical scoring sheets as used for items one through thirty.

Item Bank

The text, Inquiry into Life, second edition, by Sylvia S. Mader was used in the introductory biology course for the first time during the Spring of 1981. As a result of this change, it was necessary to revise the test questions within the CMI item bank. The investigator felt that this project offered an opportunity in which to validate and measure the internal consistency of this revised item bank. It was hoped that content validity measures would improve the quality of the item bank for this project and that internal consistency measures would be used as a basis for improvements for future classes.

A panel of six judges, faculty members from the Biology Department, were invited to review a bank of 175 test items for content validity based on clarity and appropriateness (see Appendix C). Twenty-five items were dropped

from the original bank creating an item bank of 150 questions. The item bank consisted of ten subscales labeled according to course objective covered. The subscales were as follows:

1. Cell Organelles (structure/function)
2. Microfibril (structure/function)
3. Cell Organelles (function)
4. Plant Cells (compared and contrasted with animal cells)
5. Cell Membranes (function)
6. Movement (materials across membranes)
7. Solutions (tonicity and membranes)
8. Energy Transfer (membrane transport)
9. Mechanisms (membrane transport)
10. Cytosis

Procedure

The pretest attitude instrument on CMI was administered to student subjects on January 14, 1981. A short explanation of the research project was presented prior to the pretest (see Appendix D). Immediately following the pretest, student subjects were given a pretest of the entire 150 questions appearing in the item bank for Unit II of the course (Chapters 4 and 5 of Mader's Inquiry into Life).

On February 4, 1981, the author returned to the laboratory sections and the class was again given a brief overview of the CMI research project. Any students who had not taken the attitude pretest were administered the instrument. Final instructions for using the terminals in online testing were given. Students were asked to present their identification cards at the CAI Center in order to receive a unique user number and receive logging-on procedures. A student identification card was required for each testing session, the purpose being to insure that one student would not substitute for another.

Online use of the system was begun on February 5, 1981. Testing for Unit II was completed on March 5, 1981. During the CMI testing process, instructors were provided with class activity and scoring records on a weekly basis. Two weeks following the final testing date, the author returned to the three laboratory sections and administered the posttest attitude survey toward CMI. Instructors were given the final student activity and score tabulation. Both students and instructors were personally thanked for participation in the study. The sixty-four students testing on the CMI system averaged 3.134 attempts in completing the course module. The average score on the students' best attempt averaged 87.4%, that being roughly 26 correct out of 30 questions.

Statistical Treatment

Optical scoring sheets containing students' responses were converted onto Hollerith cards by the University testing staff. Three separate sets of card decks were produced: (a) attitude pretest deck (15 columns), (b) attitude posttest deck (45 columns), and (c) pretest of item bank (79 columns, alpha data).

Pretest-Posttest Attitude Analysis

Using student identification numbers, subject pretest and posttest attitude responses were matched. Using the Statistical Package for the Social Sciences (SPSS) software program, a related *t* test was performed on the data and the results were tabulated.

Posttest Attitude Analysis

Items one through thirty of the posttest attitude survey were analyzed using the FREQUENCIES routine of the SPSS software program. The FREQUENCIES program was used to produce means.

Pretest on Item Bank

Internal consistencies of the instrument for both the gridded scales and the total test were calculated using Cronbach's Coefficient Alpha. Calculations were performed by Program TESTAT2 (modified by Warren Hovland)

at the South Dakota State University Data Processing Center. Documentation for this program was appended (see Appendix E).

CHAPTER IV

RESULTS

Comparison of Pretest and Posttest Attitudes

Individual Item Comparisons

A comparison of pretest and posttest attitude scores revealed a significant improvement in students' attitudes toward their CMI experience. All items in Table 1 that contained a p (significance) level of less than .05 were deemed statistically significant. Each of these seven significant attitude shifts were in a positive direction. Of the remaining three items (1, 2, and 6) attitude changes were of an insignificant magnitude.

In examining the data in Table 1, the reader must be alerted to two caveats. First, the attitude instrument was designed with reverse directionality for items 1, 3, 5, and 9. This meant that lower means for these items on a posttest comparison would have indicated a growth or positive change in subjects' attitude. The second warning was in regard to the significance or p (probability) values. Significance (probability) as generated by the SPSS program was limited to four decimal places. Therefore, wherever signficance values were denoted as $<.0001$, the reader

TABLE 1. PRE-POST TEST ON STUDENT ATTITUDES TOWARD CMI
Based on a Five-Point Likert Scale of Strongly Disagree to Strongly Agree
(1=SD, 2=D, 3=U, 4=A, 5=SA)

		Pre M[a]	Post M[b]	t	p
1.	Knowing where I stand in relation to others is important.	3.45	3.55	.52	.6000
2.	Operating a terminal keyboard.	3.12	3.31	1.17	.2400
3.	Testing on a computer makes me feel that no one cares if I learn.	2.54	1.91	-4.08	<.0001
4.	Being able to take tests at a time of my own choosing.	3.61	4.20	3.60	.0005
5.	Learning will be too mechanical on CMI.	3.09	2.63	-2.76	.0067
6.	Receiving less credit for items on which you guessed correct answer.	2.54	2.25	-1.80	.0745
7.	Receiving immediate feedback to responses.	3.56	4.16	3.38	.0010
8.	Self-pacing with CMI.	3.19	3.92	5.08	<.0001
9.	Using CMI makes you feel isolated.	2.97	2.34	3.54	.0002
10.	Testing on CMI effectively uses a student's time.	3.19	3.66	3.10	.0024

a Pre M denotes Pretest response means

b Post M denotes Posttest response means

should be cognizant of the fact that computer analysis revealed a value of .0000. The letter M denoted means.

Overall Attitude Shift

In the interest of determining an overall attitude shift, this investigator collapsed the individual item scores into a composite or summated rating attitude score. To compare pretest and posttest scores in this manner, it was necessary to reverse the scale values on some of the items in the interest of measuring positive attitude growth. Therefore, using program TESTAT, items 1, 3, 5, and 9 were reversed (see Appendix F) and total scores were generated. These scores were then compared using the related *t* test (*t* test for correlated means) and the results were reported in Table 2. After examining Table 2, it was noted that overall attitude improved significantly from pretest ($M = 31.34$) to posttest ($M = 34.89$) with a *t* value of 4.54 ($p < .0001$).

Post-Experience Attitudes Toward CMI Usage

Attitudes Toward CMI Methods

Items 11 through 30 attempted to provide an indication of student attitudes toward their CMI experience at the end of the introductory biology course module. It was hoped that some of the item response means would reveal

TABLE 2. COMPOSITE STUDENT ATTITUDE SCORE TOWARD CMI
Based on a Five-Point Likert Scale of Strongly Disagree to Strongly Agree
(1=SD, 2=D, 3=U, 4=A, 5=SA)

	Pre M[a]	Post M[b]	t	p
Total of Items 1-10.	3.134	3.489	4.54	<.0001

a Pre M denotes Pretest response means

b Post M denotes Posttest response means

strong preferences and dislikes of specific CMI methods employed in this project. Table 3 shows that most (18 out of 20) means fell between 3.00 and 4.00 (undecided to agree). Strongest attitude reactions were found on items 13, 19, and 26. Item 26, which queried students on whether or not they found CMI to be both a testing and learning experience, registered the highest favorable mean rating (M = 4.188). The second highest mean was found on responses to item 19 (M = 4.031). Item 19 indicated that students agreed with the statement that CMI allowed students to move through the course material at their own rate. The third highest mean was on Item 13 (M = 4.016) and reflected agreement among students that they were concerned about answering questions incorrectly on CMI.

In Table 3, items with reversed directionality (items 13, 16, 20, 21, 24, and 27) were also given reversed values shown in parentheses. The reversed values were provided solely for the purpose of improving table readability and allowing easier mean comparisons by the reader.

Attitudes Toward Operational Components of CMI

Items 31 through 40 were administered in an attempt to determine features that students felt were particularly good or poor in the operation of the CMI facilities. In examining Table 4, it was shown that nine of the ten attitude response means fell on the positive side of the scale.

TABLE 3

POSTTEST ON STUDENT ATTITUDE TOWARD CMI
Based on a Five-Point Scale of Disagree to Agree
(1=SD, 2=D, 3=U, 4=A, 5=SA)

Feelings About:		M[c]
11.	Challenge to do best work	3.625
12.	Understanding questions on terminal	3.172
13.[a]	Concern over mistakes	1.984(4.016)[b]
14.	Conversational quality of system	3.219
15.	Individual tailoring	3.516
16.[a]	Difficulty in operating terminal	2.672(3.328)[b]
17.	Removal of test anxiety	3.750
18.	Computer malfunctions	3.200
19.	Self-pacing	4.030
20.[a]	Frustration with CMI	2.094(3.906)[b]
21.[a]	Pressure from CMI method	2.109(3.891)[b]
22.	CMI superior to traditional instruction	3.203
23.	Preference of CMI evaluation to traditional testing	3.531
24.[a]	CMI depersonalization	2.469(3.531)[b]
25.	CMI flexibility	3.563
26.	CMI as a testing and learning experience	4.188
27.[a]	Repeat items improved test scores	2.516(3.404)[b]
28.	Extra credit for confidence rating on correct responses	2.984
29.	Random answering on poor test experiences	2.625
30.	Encourage a friend to take CMI	3.266

a Reversed scored item

b Reversed scoring mean

c Posttest mean

TABLE 4

STUDENT ATTITUDE TOWARD THE
COMPUTERIZED INSTRUCTIONAL PROCESS
Based on a Five-Point Likert Scale of Good to Poor
(5=Good, 4=Adequate, 3=Fair, 2=Inadequate, 1=Poor)

Feelings About:		M[a]
31.	Introduction to use of CRT	3.250
32.	Convenience of CAI center	3.766
33.	Seating and desk space	2.953
34.	Location	3.859
35.	Helpfulness of support staff	3.562
36.	Monitoring of students	3.422
37.	Accuracy and clarity of scorekeeping	4.141
38.	Hours of operation	4.141
39.	Class preparation	3.399
40.	Operation of terminals	3.719

a Posttest mean

Highest means were recorded for item 37, scorekeeping features (M = 4.281), and item 38, operational hours (M = 4.187). The lowest mean was recorded on item 33 (M = 2.953) which denoted student dissatisfaction with seating and desk space.

Item Bank Internal Consistency Measures

The pretest covering 148 questions in the item bank was administered in order to provide a basis on which to improve item construction for future courses. Cronbach's Coefficient Alpha was determined for each subscale using program TESTAT. The results of the item analysis were placed in Appendix G. Of particular interest for test improvement were columns headed by R (total) and R (scale) which denoted the correlation of the individual items to total test score and total scale score. Higher correlation coefficients for a scale and total test item indicated a greater potential for consistency and therefore discrimination of student knowledge on objectives (subscale) being tested. Lower correlations indicated items that should be reviewed for improvement and/or elimination. The raw data of item analysis by student responses was provided in Appendix H.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of the study was to determine the attitudes of students toward a CMI biology course module and to check the internal consistency of the item bank. Specifically, the researcher was interested in whether (a) students' attitudes toward CMI improved as a result of the experience, (b) students felt positive or negative about specific affective and operational aspects of CMI, and (c) improvements should be made in the item bank.

Attitude scales were administered to student participants on a pretest and posttest basis. The first ten items were analyzed using a related t test, while thirty items given in a posttest fashion were analyzed using mean scores as overall attitude indicators. The item bank was administered as a pretest and internal consistencies of the instrument for both subscales and total test were calculated using Cronbach's Coefficient Alpha.

From the overall results obtained in the comparison of pretest and posttest attitudes of students toward CMI ($t = 4.54$ with $p < .0001$), it was apparent that subjects participating in the introductory biology CMI module

demonstrated a significant positive growth in their attitude toward the CMI method. The students indicated that CMI allowed them flexibility in testing and used their time effectively. They also indicated that CMI did not make learning too mechanical, that it did not make students feel isolated, and that it did not create an atmosphere lacking individual concerns. Students also showed a strong desire to have immediate feedback on test questions, a feature that CMI readily supplied.

From a purely informational standpoint, the single battery posttest on attitudes toward the CMI experience found subject responses generally favorable. There were slightly negative feelings toward the use of confidence testing techniques for grading purposes. Very positive feelings were shown when students were asked if CMI provided both a testing and learning experience, if it allowed self-pacing, and if it created feelings of concern over incorrect test question responses.

Internal consistency measures were rather mixed. This result was not surprising, considering it was the first administration of the test questions developed for a new text. It confirmed psychometric methods in that a strong testing instrument cannot be created in one attempt, but rather a reliable test must be constructed over a period of time and involve several test administrations.

Conclusions

Pretest and Posttest Attitude Shifts

Student attitude toward the use of computer-managed instruction in this course module showed an overall positive growth at a significance level of $p < .0001$, using the related t test ($t = 4.54$). Use of the computer terminals did not appear to make students feel that instructors lacked concern toward their learning progress. This positive response toward concern in the course was indicated by a t value of 4.08 with a significance, $p < .0001$. The nature of the CMI method and the willingness of instructors to provide individual assistance probably accounted for this positive response. The major intents of the CMI strategy were to provide: (a) more time for instructors to assist students personally in the learning process and (b) immediate diagnostic feedback for students, and thus encourage additional study or consultation with their instructors. Immediate feedback from the CMI strategy also produced a significantly positive response from participants, yielding a t value of 3.38 at a significance level $p < .001$. Not only do students prefer immediate feedback, but a study by Fisher, Williams, and Roth (1981) showed that immediate feedback elicited better test performances and improved long-term retention of knowledge.

This study also showed better student attitudes and participation in a CMI type genetics course.

Concern on the part of the author that subjects would find CMI too mechanical and isolating was rejected on the basis of the null hypothesis. Students rejected these suggested feelings of mechanization and isolation (items 5 and 9 with respective values of $\underline{t} = 2.76$ with $p < .0067$ and $\underline{t} = 3.54$ with $p < .0002$). Cathode ray terminals (CRT) have become a common sight in businesses, schools, and even homes across the country. The use of the CRT for testing and learning was not seen by participants as another new educational "gimmick". Instead, the CRT and CMI system was viewed as a practical educational tool of today. Students indicated that the system enabled them to use their time effectively (item 10 with a $\underline{t}$ value of 3.00 and $p < .0024$). It allowed students to schedule their own test taking at a time of their choosing (item 4, $\underline{t} = 3.60$ with $p < .0005$) and allowed them to establish their own individual learning and testing pace (item 8, $\underline{t} = 5.08$ with $p < .0001$). The freedom and responsibility for governing self-learning was a major advantage of this system for college students. Self-responsibility for intellectual growth should be a goal sought in a college education and it was felt by this author that CMI promoted this type of mature development.

Posttest Attitudes Toward CMI

Attitudes toward the CMI method. From a strictly informational standpoint, this researcher wished to discover which aspects of the CMI strategy students strongly favored and which ones they disliked. The largest favorable mean response (M = 4.188) was recorded for item 26, which showed marked agreement that CMI was both a testing and learning experience. The beauty of the CMI system was that it allowed the testing (evaluation) experience to become a guide for individual student study needs. Rather than the test being a "red light" in the learning process, the testing on CMI was a means to guide and promote study. It was a signal of where to begin again in the learning process.

Student participants also reacted favorably to the self-pacing aspects of CMI (item 19, M = 4.031). It would be proper to point out that self-pacing was not totally open-ended. A deadline of one month was imposed on all participants to complete their online module. Self-pacing offered a unique opportunity to show maturity and self-discipline. Since all college students would not be expected to respond in a positive manner to this challenge, a deadline was imposed.

The researcher felt that participants might not treat testing on the CMI system as seriously as they would

treat traditional situations. This appeared not to be the case. Responses to item 13 (M = 1.984) indicated that subjects expressed substantial concern over incorrect test responses on CMI. In contrast, subjects showed marked agreement (item 17, M = 3.750) that CMI removed test anxiety. This would indicate that the CMI experience was regarded as a serious evaluation, yet it did not produce a great deal of anxiety. It would appear that the spirit behind testing should be to promote learning and understanding rather than to promote anxiety and grade assignment. This was not to say that CMI would in itself be an answer to better instruction and learning. In fact, item 22, which asked if CMI were superior to traditional instruction, showed uncertainty with a mean of M = 3.200. However, as an evaluative tool, there appeared to be a relatively positive response to CMI testing in comparison to traditional testing (item 33, M = 3.500).

Attitudes toward operational aspects of CMI. Participants' reactions to the operational (physical) components of the CMI system were generally good. Students particularly liked the lengthy computer center hours, those being 9:00 a.m. until 10:00 p.m. (item 38, M = 4.187). The long hours certainly allowed for great flexibility in test time selection. Participants also liked the score-

keeping system. Item 37 (M = 4.281) showed that students found the individual records to be clear and accurate.

On the negative side of the scale, seating and desk space in the testing area were rated below "fair" (item 33, M = 2.953). Fortunately, the cramped and crowded facilities at the testing area have been greatly improved by relocation to a new set of rooms. Finally, student orientation to the use of CRT's received a "fair" rating (item 31, M = 3.250). It was the opinion of the author that a better introduction to CRT usage could have been accomplished in a group setting. The staff at the testing facility have been very cooperative in providing group orientation programs.

Internal Consistency Measures of the Item Bank

The researcher undertook internal consistency measures of the item bank in the interest of providing an initial basis for improving a future course item bank. It was not the intention of this investigator to establish psychometric parameters on which to judge the quality of all items. The intent was to provide measures of internal consistency for items compared to the total test and to assigned subscales and make some general comments on possible avenues for item bank improvement.

Correlation coefficients ranged on total test internal consistency measures from a high of .55 (item 22) to a low of -.25 (item 8). Subscale coefficients ranged from a high of .73 (item 142) to a low of -.08 (item 25). Again, it would have been presumptuous on the part of this investigator to establish acceptable psychometric standards for this course. However, it was felt worth noting that some of the extremes in internal consistency measures were probably due to the small size of some subscales. Two ways that one could possibly improve the instruments would be to: (a) enlarge the size of the item bank by adding more questions to the smaller subscales or (b) attempt to balance the subscales by adding items to smaller subscales and deleting those with low correlation coefficients from the much larger subscales.

An additional product of the TESTAT program for internal consistency was the item choice distributions found also in Appendix H. These distributions would be helpful in identifying poor distractors within individual test questions. It should be emphasized that additional pretests and also posttests followed by critical psychometric analysis would provide the best avenue for continued improvement of the item bank. Not only would this procedure insure objective and fair testing measures for each student; improved self-evaluation and improved diagnosis of learning needs would also be an expected result.

Recommendations

The time for computer-managed instruction usage on a regular basis at South Dakota State University is nearly at hand. Student attitudes are positive toward CMI and instructors have shown a willingness to participate in CMI. Functional interactive instructional software has been developed by a cooperative and supportive data processing staff. The only blockage on the road to CMI utilization on a regular basis is the purchase of a university computer large enough to handle student demand. It is basically a matter of time before a new and larger capacity computer will replace the current data processing unit which is beleaguered by overuse. When larger and better hardware equipment is installed, it is the opinion of this author that biology instructors should develop several biology courses using CMI packages.

In designing these courses, instructors would be well advised to monitor student progress through the CMI modules. Students that fall behind in testing and coursework often lack the self-discipline to pace themselves. These students are prime candidates for course incompletes and instructors can help by setting the pace for these students and thus insure that they will complete the course. A CMI system would allow for easy monitoring of all students, providing an instructor with the ability to provide individual attention and assistance with course study.

Finally, in regard to areas for additional studies, it would be most interesting to ascertain instructor attitudes toward CMI. The success of CMI to a large extent will depend upon instructor satisfaction with the system. Another area which would be fertile grounds for research is in the comparison of CMI and traditional teaching methods at South Dakota State University in terms of student learning and test performance.

REFERENCES

Allen, M. W., Meleca, C. B., & Myers, G. A. A model for the computer management of modular, individualized instruction. Clarion, Iowa: Allen, 1972.

Austreim, D. J. The relationship between student confidence and performance in computer managed instruction. Unpublished masters research paper, South Dakota State University, 1975.

Cartwright, G. F. & Derevensky, J. L. An attitudinal study of computer-assisted testing as a learning method. Psychology in the Schools, 1976, 13 (3), 317-321.

Cartwright, G. F. & Derevensky, J. L. An attitudinal study of computer-assisted testing as a learning method. Washington, D. C.: National Citizens Conference on Rehabilitation of the Disabled and Disadvantaged, 1975. (ERIC Document Reproduction Service No. ED 170 721)

Cowen, D. D. Computers in instruction. In A. S. Knowles (Ed.), International encyclopedia of higher education (Vol. 3). San Francisco: Jossey-Bass, 1977.

Dobrovolny, J. L., McCombs, B. L., and Judd, W. A. Time management skill training and procedures for increasing student efficiency in a computer-managed instructional environment. St. Louis: McDonnell Douglas Astronautics Co., 1979. (ERIC Document Reproduction Service No. ED 172 783)

Dunn, T. G. The effects of various review paradigms on performance in an individualized computer-managed undergraduate course. Tallahassee, Fla.: Florida State University, 1971. (ERIC Document Reproduction Service No. ED 063 792)

Fisher, K., Williams, S., & Roth, J. Qualitative and quantitative differences in learning associated with multiple-choice testing. Journal of Research in Science Teaching, 1981, 18 (5), 449-464.

Geisinger, K. F. A systems approach to item production and review in a computer managed instruction project.

University Park, Penn.: Pennsylvania State University, 1976. (ERIC Document Reproduction Service No. ED 121 280)

Hammer, M. & Henderson, C. O. Improved large enrollment undergraduate instruction with computer generated, repeatable tests. Pullman, Wash.: Washington State University, 1972. (ERIC Document Reproduction Service No. ED 076 027)

Hansen, D. N., Ross, S. M., Bowman, H. L., & Thurmond, P. Navy computer managed instruction: Past, present, and future. Memphis, Tenn.: Memphis State University, 1975. (ERIC Document Reproduction Service No. ED 114 051)

Kromhout, O. M., Edwards, S., & Schwarz, G. A computer-guided, general education physics course. American Journal of Physics, 1969, 37 (10), 995-1007.

Kulik, J. A., Kulik, C. C., & Cohen, P. A. Effectiveness of computer-based college teaching: A meta-analysis of findings. Review of Educational Research, 1980, 50 (4), 525-543.

Lawler, R. M., Dick, W., & Riser, M. Mastery learning and remedial prescriptions in computer-managed instruction. Journal of Experimental Education, 1974, 43 (2), 45-52.

McCombs, B. V., Eschenbrenner, A. J., & O'Neil, H. F. An adaptive model for utilizing learner characteristics in computer based instructional systems. Educational Technology, 1973, 13, 47-51.

O'Neil, H. F. Effects of stress on state anxiety and performance in computer-assisted learning. Detroit: Management Information Services, 1970.

O'Neil, H. F., Hedl, J. J., Richardson, F. C., & Judd, W. A. An affective and cognitive evaluation of computer-managed instruction. Educational Technology, 1976, 16, 29-34.

Parkus, L. Computer-assisted instruction in elementary/secondary education: The state of the art. In Tickton, S. G. (Ed.), To improve learning (Vol. 1). New York: Bowker, 1970.

Roll, J. H. & Pasen, R. M. Computer-managed instruction produces better learning in an introductory psychology course. Palatine, Ill.: Harper College, 1977. (ERIC Document Reproduction Service No. ED 156 209)

Stern, H. W. An example of the application of cost-effectiveness techniques in a computer-based study management system evaluation. San Diego, Calif.: Navy Personnel and Research Development Center, 1978. (ERIC Document Reproduction Service No. ED 165 708)

Torop, W. An analysis of individualized learning system chemistry. West Chester, Penn.: West Chester State University, 1975. (ERIC Document Reproduction Service No. ED 110 321)

Towle, N. J., Cohen, P. S., & Cohen, L. R. A case study in the use of computers to personalize instruction. Tallahassee, Fla.: Florida State University, 1973. (ERIC Document Reproduction Service No. ED 079 986)

APPENDIX A

STUDENT ATTITUDE TOWARD COMPUTER-MANAGED INSTRUCTION (PRETEST)

STUDENT ATTITUDE TOWARD COMPUTER-MANAGED INSTRUCTION

There is no one "right" or "wrong" answer to any question. We are interested in your opinion on each of the statements below. Your opinions will be strictly confidential. Do not hesitate to put down exactly how you feel about each item. Please mark the scale letter that corresponds closest to your feeling about each statement on the separate answer sheet.

1. In a situation where I am trying to learn, it is important to me to know where I stand in relation to others.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

2. I am not overly concerned about mechanically handling a terminal keyboard for testing purposes.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

3. Testing and evaluation on a computer terminal makes me feel that no one cares whether I learn or not.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

4. I like being able to take tests at a time of my own choosing.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

5. I am concerned that Computer-Managed Instruction will make learning too mechanical.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

6. I feel that it would be fair to receive less credit for correct responses to test questions for which I indicate that I am very unsure or guessing.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

7. I like to know immediately whether or not my answers to test questions are correct.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

8. I feel that I can work satisfactorily at my own pace with Computer-Managed Instruction.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

9. Computer-Managed Instruction will make (makes) me feel isolated and alone during part of the course.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

10. Computer-Managed Instruction will use (uses) a student's time more effectively.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

APPENDIX B

STUDENT ATTITUDE TOWARD COMPUTER-MANAGED INSTRUCTION (POSTTEST)

STUDENT ATTITUDE TOWARD COMPUTER-MANAGED INSTRUCTION

There is no one "right" or "wrong" answer to any question. We are interested in your opinion on each of the statements below. Your opinions will be strictly confidential. Do not hesitate to put down exactly how you feel about each item. Please mark the scale letter that corresponds closest to your feeling about each statement on the separate answer sheet.

1. In a situation where I am trying to learn, it is important to me to know where I stand in relation to others.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

2. I am not overly concerned about mechanically handling a terminal keyboard for testing purposes.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

3. Testing and evaluation on a computer terminal makes me feel that no one cares whether I learn or not.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

4. I like being able to take tests at a time of my own choosing.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

5. I am concerned that Computer-Managed Instruction will make learning too mechanical.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

6. I feel that it would be fair to receive less credit for correct responses to test questions for which I indicate that I am very unsure or guessing.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

7. I like to know immediately whether or not my answers to test questions are correct.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

8. I feel that I can work satisfactorily at my own pace with Computer-Managed Instruction.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

9. Computer-Managed Instruction will make (makes) me feel isolated and alone during part of the course.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

10. Computer-Managed Instruction will use (uses) a student's time more effectively.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

11. In a Computer-Managed Instruction setting, I feel challenged to do my best work.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

12. I am concerned that I might not understand the material presented via a computer terminal.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

13. I am not concerned when I miss a question because no one is watching me anyway.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

14. While taking Computer-Managed Instruction, I feel as if someone were engaged in conversation with me.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

15. I am aware of efforts to suit the method of instruction and review of material specifically to me.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

16. I feel that more is involved in running the terminal than in understanding the material presented.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

17. Testing on the computer terminal takes away pressures related to conventional classroom tests.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

18. I rarely encounter computer malfunctions on CMI.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

19. Computer-Managed Instruction allows me to progress through the course material at my own speed.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

20. I feel frustrated by the Computer-Managed Instruction situation.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

21. I could score better if I felt less pushed by the CMI system.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

22. In view of the amount of learning required in this course, I would say Computer-Managed Instruction is superior to traditional instruction.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

23. With a course such as this, I would prefer CMI evaluation rather than traditional testing.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

24. I am not in favor of Computer-Managed Instruction because it is just another step toward depersonalized instruction.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

25. The Computer-Managed Instruction approach is flexible.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

26. Computer-Managed Instruction is both a testing and learning experience.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

27. Repeat questions from the test item bank would not significantly improve my later test scores.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

28. I feel that it would be fair to receive extra credit for correct responses on items for which I indicated certainty in my confidence.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

29. When I miss several questions in the first half of a test, I answer randomly on later items in order to quickly finish the test.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

30. I would encourage a friend to take a computer-managed course rather than a conventional class.

Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
(A)	(B)	(C)	(D)	(E)

In regard to the computerized instructional process which you have been exposed to, please respond to the following on a scale of "A" to "E". For example, if you feel that a statement is between "good" and "fair", mark the letter "B".

		Good		Fair		Poor
31.	Introduction to the use of CRT terminals.	A	B	C	D	E
32.	Convenience of the CAI center location.	A	B	C	D	E
33.	CAI center seating and desk space.	A	B	C	D	E
34.	Availability of terminals for usage.	A	B	C	D	E
35.	Helpfulness of support staff at CAI center.	A	B	C	D	E
36.	Monitoring of students taking mastery tests.	A	B	C	D	E
37.	Accuracy and clarity of score-keeping.	A	B	C	D	E
38.	Operating hours of CAI center.	A	B	C	D	E
39.	Classroom preparation for examination.	A	B	C	D	E
40.	Operation of computer terminals.	A	B	C	D	E

APPENDIX C

INSTRUCTIONS TO FACULTY EVALUATORS

Dear Faculty Evaluator:

In an attempt to validate the content of questions within an introductory biology test item bank, we are asking you as a subject authority to evaluate the accompanying list of questions. Would you please rate each question on the basis of clarity and appropriateness using a five point scale.

1) For clarity, record the number for the following scale which most closely approximates your evaluation of the question's clarity:

Very vague or confusing	Vague or difficult to follow	Questionable or unsure	Acceptably understandable	Clear
1	2	3	4	5

If you felt the question was vague, write a "2" in the first blank under the column labeled clarity.

2) For appropriateness, record the number from the following scale which most closely approximates your evaluation of the question's appropriateness in an introductory college level course:

Not appropriate	Somewhat inappropriate	Questionable or unsure	Acceptably appropriate	Appropriate
1	2	3	4	5

If you felt the question was appropriate for an introductory college level biology course, mark a "5" in the blank under the column labeled appropriateness.

If you feel the wording of a question could be significantly improved, please feel free to pencil in any suggested changes or comments on the printout. Your frankness and cooperation in this task is appreciated by both Dr. Gerald Myers and his graduate student Marty Steffenson.

APPENDIX D

INSTRUCTIONS TO STUDENT PARTICIPANTS

CMI STUDY-BIOLOGY 151

This laboratory section has been selected to participate in a brief study involving the use of Computer-Managed Instruction (CMI). As a participant in this study, you will be given an opportunity to preview the types of questions you will encounter as a portion of this course. The study will require you to perform four tasks:

1) 10-question Attitude Questionnaire
2) Sample of 150 questions covering Unit II
3) Completion of CMI test for Unit II
4) 40-question Attitude Questionnaire.

The Unit II portion of your first hour exam will be administered by Computer-Managed Instruction using a cathode ray terminal (CRT) located in the Computer-Assisted Instruction Center, 3rd floor, Administration Building. User number assignment and instruction in the use of the CRT will be provided by the CAI staff early in the semester. You will be notified by your instructor when you can begin to use the CMI testing system. Completion of test taking will be set on or about February 26, the date of the first lecture examination.

Testing on the CMI system offers several distinct advantages for students. Tests may be taken largely at the time of your own choosing. In addition, the test may be taken up to three times in order to achieve mastery

level (roughly, a "C"). If a student wishes to improve his or her score, it is possible to continue study and testing in an attempt to reach a desired score. Only the highest score attained will be recorded for course grading purposes. The test items that make up each CMI test session are generated from a very large test item bank. Therefore, each test will be constructed of different questions covering the same course objectives.

We hope that this experience will be a positive one for you. If you have any questions, problems, or difficulties concerning the CMI portion of the course, feel free to talk to your instructor or either Dr. Gerald Myers, Biology Department Head, Agricultural Hall, or Mr. Martin Steffenson, Reference Department Head, Hilton M. Briggs Library.

Tasks 1 and 2 can be completed during the first laboratory session. You are strongly encouraged to do as well as possible in answering the questions on the sample test. Answer <u>each</u> and <u>every</u> question to the best of your ability. If you do not know the answer to a question, try to eliminate one or more response options. There is no penalty for guessing.

APPENDIX E

DOCUMENTATION FOR TESTAT2

DESCRIPTION: This program runs an item analysis and will score items according to your key (includes reverse directionality if needed). Using subscales that you desire, subtotals will be computed and can be punched onto a separate data card for each subject. Output includes: Means, Sigmas, Alphas, choice distributions (optional), and punched output consisting of subscale totals and composite totals (optional).

RESTRICTIONS: MAXIMUM OF 150 TEST ITEMS, 'A' FORMAT MUST BE USED TO READ ID, 'I' FORMAT MUST BE USED FOR TEST ITEMS. DIRECTIONALITY KEY REQUIRES TWO CARDS, 'A' format must be used when inputting 1230 data.

INPUT: Job Card — This yellow card must be placed on the top of each run. It contains information used for billing purposes, and is not included in the following example.

JCL Card (2 options)

Option 1 - If you want the print-out on regular computer paper

```
cc = 1-15
// EXEC TESTAT2
```

Option 2 - If you want the print-out on 8 1/2 by 11 white paper, printed on the laser printer (@ 7¢/page) use the following instead of the above.

```
cc = 1-36
// EXEC TESTAT2,OUT='A,DEST=RE667Ø'
```

Card (3) PROGRAM NAME (Required-may take all 80 col.)

Card (4) CONTROL CARD (Required)

- 1-5 Number of items (MAX-150)
- 6-10 Number of subjects
- 11 Data input option
  - Ø: Item punched (use when data is punched on our IBM cards)
  - 1: 1230-cards (use only when using special 1230 cards)
- 12 Printout option
  - 1=print choice distributions as punched
  - Ø=no printing of choice distribution
- 13 Enter number of choices per item if directionality is to be reversed for keyed items. If blank, no directionality key card will be expected
  (MAX choices = 5 for 1230 card input)
  (MAX choices = 9 for IBM card input)

14 — 1 will convert choices to 1=right Ø-wrong (use correct choice key-see below)
Ø means no correct-choice key will be involved

15 — punch Ø

16 — Constant you want to replace blank items (Ø if no constant is desired)

17 — *Punch option: 1=punch cards for subjects (Sub-totals and total score)

18-19 — Number of subscales (if <1Ø use zero and right justify - i.e. Ø9)

Card (5) FORMAT CARD (Required)

Card 7-K KEY CARDS (All optional depending on your input data)

DIRECTIONALITY KEY. The directionality function requires 2 cards - they are:
A.-Card: Beginning in Col. 6 Code 1 for reversals in the column corresponding to the item to be reversed.
B.-Card: Beginning in Col. 6 Code the choice matrix in fields of 2. Example:

Col.	1	2	3	4	5	6	7	8	9	1Ø	11	12	13	14	15
						Ø	1	Ø	2	Ø	3	Ø	4	Ø	5

RIGHT-WRONG SCORING KEY.(When Control Card Col. 14 = 1). If this key exceeds the length of the first card, continue the key beginning in Col. 6 on card(s) 2, 3 if necessary.
(If Control Card Col. 11 = 1, this Key Card should be a 1230 Card)
SUBSCALE KEY.(When Control Card Col. 18-19 = Non-zero)
Beginning in Col. 1, code subscale number using a two (2) column format (Ø1Ø1Ø2121313 etc.). If this key exceeds the length the first card, continue the key beginning in Col. 1 on cards 2, 3, 4 etc.

* *

DATA GOES HERE

* *

Final Card COMPLETION CARD (Required)
1-2 /*

If cards are to be punched, be sure to state: "THIS PROGRAM PUNCHES CARDS" on your job card.

APPENDIX F

ITEM REVERSAL KEY FOR ATTITUDE PRETEST

ITEM REVERSAL KEY FOR ATTITUDE PRETEST

		SD	D	U	A	SA
1.	It is important to know where I stand in relation to others.	1	2	3	4	5
2.	Mechanically handling a terminal keyboard.	1	2	3	4	5
3.	Testing on a computer makes me feel that no one cares whether or not I learn.	5	4	3	2	1
4.	I like being able to take tests at a time of my own choosing.	1	2	3	4	5
5.	CMI will make learning too mechanical.	5	4	3	2	1
6.	Confidence testing-receive less credit for items on which you guessed correct answer.	1	2	3	4	5
7.	Immediate feedback on test question response.	1	2	3	4	5
8.	Self-pacing with CMI.	1	2	3	4	5
9.	Does CMI make you feel isolated and alone.	5	4	3	2	1
10.	Does CMI use a student's time effectively.	1	2	3	4	5

APPENDIX G

PRETEST INTERNAL CONSISTENCY MEASURES FOR ITEM BANK

PRETEST INTERNAL CONSISTENCY MEASURES

PARAMETERS
COL 1- 5 = 148
COL 6-10 = 58
COL 11-15 = 11010
COL 16-20 = 100
COL 21-25 = 0

DATA FORMAT = (A5,74A1)

ITEM	1	2	3	4	5	6	7	8	9	10
	32.0000	8.0000	43.0000	12.0000	17.0000	3.0000	18.0000	7.0000	2.0000	6.0000
ITEM	11									
	148.0000									
MEAN	1	2	3	4	5	6	7	8	9	10
	13.8103	2.6207	18.5172	6.5000	6.1552	1.2069	7.5000	1.8276	0.6724	1.7931
MEAN	11									
	60.6034									
SIGM	1	2	3	4	5	6	7	8	9	10
	4.4430	1.2293	7.2594	2.3063	2.2499	0.8461	2.4442	1.1008	0.6795	1.2698
SIGM	11									
	16.7969									
ALPH	1	2	3	4	5	6	7	8	9	10
	0.6873	0.1290	0.8420	0.5538	0.3286	0.0411	0.3789	-0.0298	0.0721	0.2805
ALPH	11									
	0.8967									

ITEM	SCALE	MEAN	SIGMA	R(TOTAL)	R(SCALE)
1	1	0.29	0.455	0.2317	0.2832
2	1	0.78	0.417	0.2556	0.3307
3	1	0.10	0.305	0.0316	-0.0110
4	1	0.47	0.499	0.4665	0.5766
5	1	0.29	0.455	-0.1990	0.0531
6	1	0.34	0.475	0.1877	0.2596
7	1	0.48	0.500	0.5384	0.5538
8	1	0.36	0.481	0.0114	0.2663
9	1	0.22	0.417	0.2515	0.1998
10	1	0.40	0.489	0.1387	0.1536
11	1	0.59	0.493	0.3970	0.2951
12	1	0.41	0.493	0.3700	0.3353
13	1	0.33	0.469	0.5064	0.4928
14	1	0.53	0.499	0.2126	0.2714
15	1	0.36	0.481	0.2228	0.2421
16	1	0.41	0.493	0.2783	0.1856
17	1	0.84	0.362	0.3187	0.3675
18	1	0.29	0.455	-0.0231	0.1213
19	1	0.79	0.405	0.2819	0.3327
20	1	0.17	0.378	0.3885	0.4612
21	1	0.24	0.428	0.2172	0.3959
22	1	0.34	0.475	0.5505	0.5372
23	1	0.36	0.481	0.4492	0.5328
24	1	0.38	0.485	0.3379	0.4173
25	1	0.16	0.362	-0.1827	-0.0782
26	1	0.22	0.417	-0.0808	0.0043
27	1	0.79	0.405	0.4086	0.3710
28	1	0.50	0.500	0.3336	0.3687
29	1	0.43	0.495	0.3605	0.4838
30	1	0.48	0.500	0.0413	0.1267
31	1	0.83	0.378	0.4919	0.4736
32	1	0.59	0.493	0.1802	0.2557
33	2	0.31	0.463	0.2843	0.4495
34	2	0.36	0.481	0.0989	0.4367
35	2	0.21	0.405	0.2832	0.2961
36	2	0.88	0.326	0.3820	0.3593
37	2	0.36	0.481	0.1417	0.5243
38	2	0.05	0.221	0.0148	0.1354
39	2	0.26	0.438	-0.2322	0.2143
40	2	0.19	0.392	0.1554	0.5070
41	3	0.43	0.495	0.5159	0.5327
42	3	0.33	0.469	0.4714	0.5626
43	3	0.28	0.447	0.3154	0.2961
44	3	0.26	0.438	0.3679	0.3105
45	3	0.38	0.485	0.3104	0.3114
46	3	0.40	0.489	0.4955	0.5297
47	3	0.40	0.489	0.2290	0.2384
48	3	0.62	0.485	0.3348	0.4228
49	3	0.34	0.475	0.3043	0.3331
50	3	0.24	0.428	0.1980	0.2817
51	3	0.38	0.485	0.2681	0.3604
52	3	0.45	0.497	0.4011	0.3847
53	3	0.76	0.428	0.3081	0.3677
54	3	0.81	0.392	0.2949	0.2586
55	3	0.26	0.438	0.2413	0.2562
56	3	0.33	0.469	0.6289	0.6132
57	3	0.76	0.428	0.3993	0.3621
58	3	0.17	0.378	0.0624	0.1372
59	3	0.33	0.469	0.2855	0.2488
60	3	0.47	0.499	0.4974	0.5525
61	3	0.52	0.500	0.3654	0.4776

62	3	0.31	0.463	0.2421	0.2859
63	3	0.48	0.500	0.2919	0.4302
64	3	0.43	0.495	0.4600	0.5375
65	3	0.48	0.500	0.3782	0.4112
66	3	0.43	0.495	0.4973	0.5039
67	3	0.26	0.438	0.1991	0.1478
68	3	0.29	0.455	0.5000	0.5489
69	3	0.59	0.493	0.5095	0.5807
70	3	0.29	0.455	0.3783	0.3872
71	3	0.60	0.489	0.2432	0.3539
72	3	0.48	0.500	0.2467	0.3209
73	3	0.33	0.469	0.4233	0.4563
74	3	0.76	0.428	0.3393	0.4010
75	3	0.66	0.475	0.1600	0.2216
76	3	0.22	0.417	-0.0316	0.0300
77	3	0.50	0.500	0.4219	0.4703
78	3	0.74	0.438	0.2392	0.2590
79	3	0.52	0.500	0.1477	0.1591
80	3	0.43	0.495	0.2278	0.2497
81	3	0.24	0.428	0.3180	0.2595
82	3	0.22	0.417	0.2884	0.2465
83	3	0.34	0.475	0.3281	0.2981
84	4	0.24	0.428	0.3803	0.4193
85	4	0.53	0.499	0.4389	0.6220
86	4	0.47	0.499	0.3554	0.3522
87	4	0.52	0.500	0.1929	0.3441
88	4	0.76	0.428	0.3177	0.4018
89	4	0.48	0.500	0.4850	0.6134
90	4	0.29	0.455	-0.0502	0.1396
91	4	0.72	0.447	0.5297	0.5520
92	4	0.72	0.447	0.3207	0.4516
93	4	0.36	0.481	-0.0121	0.1478
94	4	0.74	0.438	0.2158	0.3500
95	4	0.66	0.475	0.4796	0.5348
96	5	0.64	0.481	0.3795	0.3390
97	5	0.19	0.392	-0.3159	0.1035
98	5	0.22	0.417	0.0767	0.2202
99	5	0.28	0.447	0.0720	0.3346
100	5	0.74	0.438	0.3916	0.3032
101	5	0.34	0.475	0.0819	0.2724
102	5	0.40	0.489	-0.0837	0.2261
103	5	0.33	0.469	0.0646	0.2947
104	5	0.43	0.495	-0.0209	0.1721
105	5	0.57	0.495	0.5868	0.5552
106	5	0.45	0.497	0.2669	0.2460
107	5	0.40	0.489	0.2793	0.5394
108	5	0.16	0.362	0.2256	0.2456
109	5	0.31	0.463	0.3864	0.4341
110	5	0.24	0.428	0.0949	0.3013
111	5	0.21	0.405	0.0906	0.1918
112	5	0.26	0.438	-0.0329	0.1168
113	6	0.40	0.489	0.4346	0.6349
114	6	0.29	0.455	0.3038	0.5141
115	6	0.52	0.500	0.1744	0.6033
116	7	0.26	0.438	0.1288	0.2014
117	7	0.29	0.455	0.1009	0.1472
118	7	0.50	0.500	0.2884	0.2751
119	7	0.57	0.495	0.2303	0.4344
120	7	0.14	0.345	0.0511	0.1841
121	7	0.47	0.499	0.3760	0.4172
122	7	0.47	0.499	0.1764	0.4455
123	7	0.59	0.493	0.2865	0.3724

124	7	0.33	0.469	0.0515	0.3231
125	7	0.60	0.489	0.3502	0.3965
126	7	0.66	0.475	0.4169	0.3710
127	7	0.76	0.428	0.1762	0.2967
128	7	0.43	0.495	0.2921	0.2635
129	7	0.28	0.447	0.0329	0.2052
130	7	0.50	0.500	0.0770	0.2187
131	7	0.19	0.392	0.2471	0.1889
132	7	0.22	0.417	0.1431	0.2960
133	7	0.26	0.438	0.1921	0.1853
134	8	0.19	0.392	-0.2452	0.3555
135	8	0.16	0.362	-0.0097	0.1104
136	8	0.17	0.378	-0.1115	0.2374
137	8	0.40	0.489	0.3066	0.4472
138	8	0.14	0.345	0.2029	0.4715
139	8	0.29	0.455	0.3444	0.5482
140	8	0.48	0.500	0.1625	0.4021
141	9	0.31	0.463	0.2666	0.7074
142	9	0.36	0.481	0.2399	0.7328
143	10	0.41	0.493	0.3512	0.6056
144	10	0.33	0.469	0.1083	0.5477
145	10	0.29	0.455	0.1077	0.5225
146	10	0.26	0.438	-0.1384	0.2823
147	10	0.22	0.417	0.3228	0.3481
148	10	0.28	0.447	0.2144	0.4651

APPENDIX H

ITEM CHOICE DISTRIBUTIONS FOR ITEM BANK

CHOICE DISTRIBUTIONS (PERCENTAGES).

ITEM	REV	KEY	ZERO	1	2	3	4	5	6	7	8	9
1	0	1	0	29	16	48	7	0	0	0	0	0
2	0	3	0	2	3	78	17	0	0	0	0	0
3	0	2	0	50	10	24	16	0	0	0	0	0
4	0	4	0	14	28	12	47	0	0	0	0	0
5	0	2	2	16	29	7	45	2	0	0	0	0
6	0	2	0	17	34	26	22	0	0	0	0	0
7	0	1	0	48	19	21	12	0	0	0	0	0
8	0	3	0	26	26	36	12	0	0	0	0	0
9	0	4	2	40	21	16	22	0	0	0	0	0
10	0	3	0	24	26	40	10	0	0	0	0	0
11	0	4	0	2	12	28	59	0	0	0	0	0
12	0	4	0	10	14	33	41	2	0	0	0	0
13	0	4	0	5	28	34	33	0	0	0	0	0
14	0	2	0	31	53	3	12	0	0	0	0	0
15	0	1	0	36	3	0	60	0	0	0	0	0
16	0	2	0	29	41	14	16	0	0	0	0	0
17	0	2	0	3	84	9	3	0	0	0	0	0
18	0	3	0	19	28	29	24	0	0	0	0	0
19	0	3	0	16	5	79	0	0	0	0	0	0
20	0	3	0	34	22	17	26	0	0	0	0	0
21	0	2	0	14	24	33	29	0	0	0	0	0
22	0	1	0	34	19	31	14	2	0	0	0	0
23	0	4	0	17	22	24	36	0	0	0	0	0
24	0	3	0	33	10	38	19	0	0	0	0	0
25	0	2	0	34	16	22	28	0	0	0	0	0
26	0	2	0	33	22	26	19	0	0	0	0	0
27	0	4	0	7	10	3	79	0	0	0	0	0
28	0	4	0	12	10	28	50	0	0	0	0	0
29	0	3	0	16	22	43	19	0	0	0	0	0
30	0	2	0	14	48	16	22	0	0	0	0	0
31	0	1	0	83	5	7	5	0	0	0	0	0
32	0	4	0	9	16	17	59	0	0	0	0	0
33	0	2	0	21	31	12	36	0	0	0	0	0
34	0	2	0	10	36	33	21	0	0	0	0	0
35	0	3	0	19	45	21	16	0	0	0	0	0
36	0	1	0	88	7	2	3	0	0	0	0	0
37	0	3	0	14	43	36	7	0	0	0	0	0
38	0	2	0	57	5	24	14	0	0	0	0	0
39	0	2	0	28	26	36	10	0	0	0	0	0
40	0	3	0	43	19	19	19	0	0	0	0	0
41	0	3	0	12	21	43	24	0	0	0	0	0
42	0	1	0	33	34	22	10	0	0	0	0	0
43	0	1	0	28	10	19	43	0	0	0	0	0
44	0	1	0	26	26	19	29	0	0	0	0	0
45	0	2	0	21	38	19	22	0	0	0	0	0
46	0	2	0	17	40	34	9	0	0	0	0	0
47	0	4	0	14	22	24	40	0	0	0	0	0
48	0	2	0	0	62	14	24	0	0	0	0	0
49	0	3	0	31	17	34	17	0	0	0	0	0
50	0	3	0	7	22	24	47	0	0	0	0	0
51	0	4	0	9	36	17	38	0	0	0	0	0
52	0	1	2	45	17	12	24	0	0	0	0	0
53	0	3	0	7	17	76	0	0	0	0	0	0
54	0	2	0	2	81	16	2	0	0	0	0	0
55	0	2	0	19	26	24	31	0	0	0	0	0
56	0	3	0	28	16	33	24	0	0	0	0	0
57	0	3	0	16	0	76	9	0	0	0	0	0
58	0	2	2	16	17	29	34	2	0	0	0	0

E59	0	3	0	16	38	33	14	0	0	0	0	0
60	0	4	2	7	28	17	47	0	0	0	0	0
61	0	3	2	12	31	52	3	0	0	0	0	0
62	0	2	0	17	31	28	22	2	0	0	0	0
63	0	1	0	48	19	22	10	0	0	0	0	0
64	0	1	0	43	12	17	28	0	0	0	0	0
65	0	4	0	28	16	9	48	0	0	0	0	0
66	0	4	0	36	5	16	43	0	0	0	0	0
67	0	1	0	26	22	21	31	0	0	0	0	0
68	0	4	0	22	36	12	29	0	0	0	0	0
69	0	4	0	7	19	16	59	0	0	0	0	0
70	0	1	0	29	34	12	24	0	0	0	0	0
71	0	3	0	22	7	60	10	0	0	0	0	0
72	0	3	0	19	16	48	17	0	0	0	0	0
73	0	1	0	33	22	19	24	2	0	0	0	0
74	0	3	0	12	10	76	2	0	0	0	0	0
75	0	1	0	66	10	19	5	0	0	0	0	0
76	0	3	0	22	33	22	22	0	0	0	0	0
77	0	4	0	2	26	22	50	0	0	0	0	0
78	0	4	0	7	16	3	74	0	0	0	0	0
79	0	3	0	9	19	52	21	0	0	0	0	0
80	0	2	0	24	43	21	12	0	0	0	0	0
81	0	2	0	28	24	22	26	0	0	0	0	0
82	0	4	0	28	24	26	22	0	0	0	0	0
83	0	3	0	19	29	34	17	0	0	0	0	0
84	0	2	0	28	24	38	10	0	0	0	0	0
85	0	4	0	5	29	12	53	0	0	0	0	0
86	0	4	0	14	9	31	47	0	0	0	0	0
87	0	1	0	52	5	9	34	0	0	0	0	0
88	0	4	0	17	2	5	76	0	0	0	0	0
89	0	1	0	48	3	48	0	0	0	0	0	0
90	0	1	0	29	29	36	5	0	0	0	0	0
91	0	3	0	5	16	72	7	0	0	0	0	0
92	0	3	0	12	12	72	3	0	0	0	0	0
93	0	2	0	16	36	45	3	0	0	0	0	0
94	0	1	0	74	5	7	14	0	0	0	0	0
95	0	4	0	10	12	12	66	0	0	0	0	0
96	0	4	0	12	10	14	64	0	0	0	0	0
97	0	3	0	14	38	19	29	0	0	0	0	0
98	0	1	0	22	22	17	38	0	0	0	0	0
99	0	4	0	21	29	22	28	0	0	0	0	0
100	0	2	0	5	74	19	2	0	0	0	0	0
101	0	1	0	34	29	5	31	0	0	0	0	0
102	0	2	0	24	40	34	2	0	0	0	0	0
103	0	1	0	33	12	29	26	0	0	0	0	0
104	0	3	0	16	21	43	21	0	0	0	0	0
105	0	4	0	22	9	12	57	0	0	0	0	0
106	0	2	0	9	45	34	12	0	0	0	0	0
107	0	4	0	29	16	16	40	0	0	0	0	0
108	0	4	0	40	16	29	16	0	0	0	0	0
109	0	4	0	17	45	7	31	0	0	0	0	0
110	0	2	0	24	24	40	7	5	0	0	0	0
111	0	3	0	34	33	21	10	2	0	0	0	0
112	0	3	0	14	28	26	31	2	0	0	0	0
113	0	3	0	26	14	40	21	0	0	0	0	0
114	0	4	0	10	26	34	29	0	0	0	0	0
115	0	2	0	21	52	14	14	0	0	0	0	0
116	0	3	0	12	40	26	22	0	0	0	0	0
117	0	3	0	29	26	29	16	0	0	0	0	0
118	0	4	0	21	16	14	50	0	0	0	0	0
119	0	2	2	36	57	5	0	0	0	0	0	0
120	0	2	0	38	14	19	29	0	0	0	0	0

121	0	2	0	48	47	5	0	0	0	0	0	0
122	0	1	0	47	52	2	0	0	0	0	0	0
123	0	2	0	38	59	2	2	0	0	0	0	0
124	0	2	0	10	33	9	48	0	0	0	0	0
125	0	2	0	10	60	9	21	0	0	0	0	0
126	0	1	0	66	5	17	12	0	0	0	0	0
127	0	3	0	2	7	76	16	0	0	0	0	0
128	0	1	0	43	31	17	9	0	0	0	0	0
129	0	3	0	16	29	28	26	2	0	0	0	0
130	0	2	0	24	50	19	7	0	0	0	0	0
131	0	3	0	26	36	19	19	0	0	0	0	0
132	0	4	0	24	28	26	22	0	0	0	0	0
133	0	1	2	26	33	33	7	0	0	0	0	0
134	0	3	0	38	12	19	31	0	0	0	0	0
135	0	3	0	29	22	16	33	0	0	0	0	0
136	0	1	0	17	48	29	5	0	0	0	0	0
137	0	4	0	10	17	33	40	0	0	0	0	0
138	0	1	0	14	14	34	38	0	0	0	0	0
139	0	4	0	19	24	28	29	0	0	0	0	0
140	0	3	0	16	12	48	24	0	0	0	0	0
141	0	2	0	34	31	28	7	0	0	0	0	0
142	0	4	0	10	19	34	36	0	0	0	0	0
143	0	3	0	12	26	41	21	0	0	0	0	0
144	0	2	0	22	33	24	21	0	0	0	0	0
145	0	3	3	17	38	29	12	0	0	0	0	0
146	0	3	2	21	33	26	19	0	0	0	0	0
147	0	4	0	34	16	28	22	0	0	0	0	0
148	0	3	0	19	14	28	40	0	0	0	0	0